

**DIVISION OF ENVIRONMENT  
QUALITY MANAGEMENT PLAN**

**PART III:**

**PUBLIC WATER SUPPLY PROGRAM  
QUALITY ASSURANCE MANAGEMENT PLAN**

Revision 3  
11/01/05

Kansas Department of Health and Environment  
Division of Environment  
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0      SIGNATURES/APPROVALS

Public Water Supply Section:

\_\_\_\_\_  
(Signature, Section Chief)

\_\_\_\_\_  
(Date)

BOW QA Representative

\_\_\_\_\_  
(Signature, BOW QA Representative)

\_\_\_\_\_  
(Date)

Bureau of Water:

\_\_\_\_\_  
(Signature, Bureau Director)

\_\_\_\_\_  
(Date)

DOE QA Representative

\_\_\_\_\_  
(Signature, DOE QA Representative)

\_\_\_\_\_  
(Date)

Division of Environment:

\_\_\_\_\_  
(Signature, Division Director)

\_\_\_\_\_  
(Date)



# **1 INTRODUCTION**

## **1.1 Historical Overview of Program**

The Safe Drinking Water Act or P.L. 93-523, was passed by Congress in 1974. It established a series of national drinking water contaminant standards, or Maximum Contaminant Levels (MCLs), which set minimum acceptable levels for eight inorganic compounds, coliform bacteria, turbidity and radionuclides. Over the next 12 years, MCLs were added for two inorganic compounds, six pesticides, trihalomethanes and tritium. Additionally, EPA established 13 secondary MCLs for compounds which cause an aesthetic problem with water but not a health effect. In 1986 Congress amended the law with what is now commonly called the 1986 Amendments. These specified certain additional parameters for EPA to generate MCLs. Among the 83 regulated items were several treatment techniques which established levels of performance for the regulation of several chemicals, three inorganics and two bacteriological components. These treatment techniques established methods of treatment, levels of removal, and generally the standard of performance which would be required for future construction and operation of water treatment systems. They additionally required that all existing water supply systems be reviewed and evaluated to determine compliance. If compliance was not met, then time-frames were to be established for facility upgrades.

EPA is required by the 1996 amendments to the Safe Drinking Water Act to consider regulating 5 new contaminants at 5 year intervals. Contaminants are regulated through MCLs which if exceeded, result in a violation, or through a treatment technique, which is a method of optimizing treatment for the parameter being regulated. Violation of either results in a public water supply system (PWSS) being responsible for notifying the public of the violation and reducing the level of contaminant to below the MCL.

Since the 1976, Kansas has had primacy or the authority to administer the drinking water program with EPA oversight. This authority was supplemented with funding by the federal government for a portion of the program staff. As the program grew, the level of funding also increased. In 1992, the state legislature passed a fee fund bill which allowed certain charges to be passed onto the consumer to fund water supply programs. These monies have allowed several additional positions to be added to the program and expedited the administration of certain program functions.



## 1.2 Quality Assurance/Control Objectives

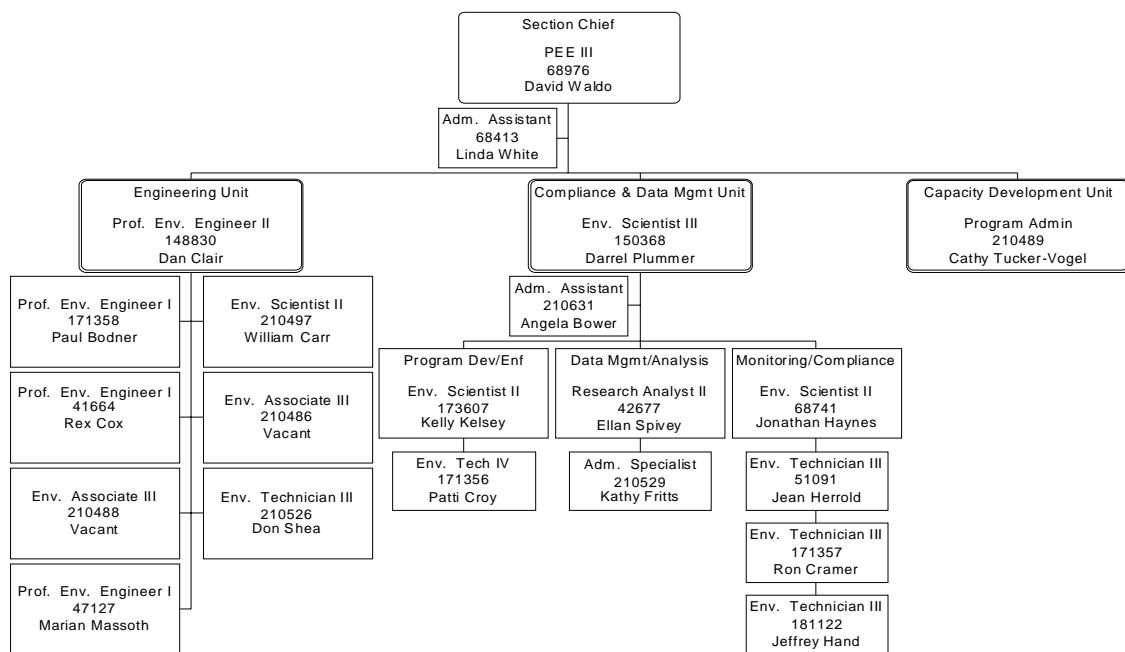
Quality assurance (QA) and quality control (QC) activities conducted within KDHE's public water supply program are intended to ensure that all monitoring and analytical data are scientifically valid, defensible and of known and acceptable precision and accuracy. The remainder of this document describes the procedural QA/QC criteria developed to meet these objectives. Standard Operating Procedures (SOPs) and equipment associated with the operation and maintenance of field and laboratory facilities are described in the appendices of this program management plan.



## 2 QUALITY ASSURANCE/CONTROL ORGANIZATION

### 2.1 Administrative Organization

The organizational framework for the public water supply program in the Bureau of Water is depicted in Figure 2.1-1. below.





## 2.2 Staff Responsibilities

The following paragraphs summarize the primary functions and responsibilities of the organizations comprising this program.

**Public Water Supply Section.** The public water supply program is administered by the Public Water Supply Section of the Bureau of Water. The PWSS is responsible for the overall administration of the program, compliance determinations and data entry of monitoring and compliance information. The program is broken down into two major groups, Engineering and Compliance. The engineering unit provides review of plans and specifications and issuance of permits. This includes generation of design standards and technical bulletins for use by outside consultants. The compliance unit reviews monitoring data and determines compliance or non-compliance. When violations occur, notices are sent to the PWSS and responses are monitored until the system returns to compliance. Both units overlap in many program areas and thus provide consistency over time.

**Technical Services Section.** Technical Services was organized in the mid 1980s and served as the parent section to the district water field staff until the formation of the Bureau of Environmental Field Services in 1993. The section provides tracking of compliance issues, for water pollution control overview of inspections, operator training and certification activities for each of the program sections.

**Bureau of Environmental Field Services (BEFS).** The Bureau of Environmental Field Services provides field services for all environmental programs in six district offices which are located in Dodge City, Hays, Salina, Wichita, Chanute and Lawrence. Environmental staff are under the supervision of the District Environmental Administrator (DEA) who provides overall management and coordination of the programs. A Professional Environmental Engineer position is assigned to each district office with responsibilities for all water programs. Staffing at all districts includes an Environmental Technician II and Environmental Technician III as authorized positions although some may be temporarily vacant at times. The Northeast and South Central districts also have assistant district engineers which are Environmental Associate III level engineering positions. Most of the sampling effort is provided by district office field staffs.



### **3 QUALITY CONTROL CRITERIA AND PROCEDURES**

#### **3.1 Monitoring Site Selection Criteria**

Monitoring is required by both state regulations and federal law. The various constituents are monitored for on different frequencies and using different methodologies. Every source of water is monitored. The selection of field monitoring sites is based on several factors including the type and purpose of the sample, representativeness, ability to document or relocate the sample site, prevention of sample contamination, accessibility, safety and specific requirements of federal regulations.

##### **3.1.1 Raw Water Sampling Sites**

All raw water sources are monitored before the supply is developed to determine compliance with MCLs and other contaminants of concern. These sampling sites are source water before the application of any treatment or chemicals. Generally, all chemical parameters are sampled at these sites to determine the level and degree of treatment necessary for compliance.

##### **3.1.2 Point of Entry Sampling Sites**

These sampling sites are unique to the PWS and are labeled with individual metal tags. These sites may be one or more sources of water after the application of treatment or chemicals. These sites are located before the first consumer. According to state regulation, the water at these sites must meet all mandatory parameters and be suitably disinfected. Generally, all parameters except trihalomethanes, lead and copper, and coliform bacteria are sampled at point of entry sites.

##### **3.1.3 Water Treatment Plant Sampling Sites**

These sites are unique to water treatment plants and generally incorporate all chemical parameters contained in both entry point and turbidity monitoring. These sites are located at the discharge of the plant and before the first consumer.

##### **3.1.4 Distribution System Sampling Sites**

Sites are located throughout the distribution system. The actual locations of these sites vary over time and due to the requirements of specific federal and state regulations. The major parameters that require water samples to be collected at sites within the distribution system are, disinfectants, disinfection by-products, micro-bacteriological and lead/copper. Additional parameters may be monitored, as needed, depending on specific compliance situations.



### 3.2 Sampling Procedures and Sample Custody

Sample containers, preservatives, and holding times must comply with 40 CFR Part 141. The sample collector shall log the date time, name, and the exact location of the sample collection.

The samples shall be analyzed using laboratory techniques approved by EPA and the State of Kansas. The analyst shall record the dates the analyses were performed, who performed the analyses, analytical techniques/methods used, and the results of such analyses.

The public water supply shall maintain the records for a minimum of five years for bacteriological results, ten years for Chemistry and 12 years for lead and copper; as required by EPA regulations.

Sample collection protocols are contained within the Standard Operating Procedures (SOPs) in appendices to this document. Topics in the SOPs include:

- a. General sampling and collection
- b. Bacteriological Sampling
- c. Inorganic Sampling
- d. VOC Sampling
- e. SOC Sampling
- f. Asbestos Sampling
- g. Radon Sampling
- h. Nitrate/Nitrite Sampling

### 3.3 Internal Procedures for Assessing Data Precision, Accuracy, Representativeness and Comparability

#### 3.1.4 Inhouse Audits

The DEAs and District Quality Assurance Officers (DQAOs), conducts annual audits of field and laboratory equipment and procedures. Each audit is comprised of (1) a system audit, consisting of a qualitative, onsite review of QA systems and facilities for monitoring, measurement and calibration and (2) a performance audit, in which a quantitative assessment is made of the bias (accuracy) and variability (repeatability and replicability) of analytical measurements. During system audits, staff responsible for



field operations are required to demonstrate consistent technique between one another; similarly, staff responsible for sample preparation and preliminary analysis must demonstrate consistent analytical technique between one another. The section chief is responsible for maintaining a log of audit results and for summarizing these results in annual QA reports to the deputy division director (see section 3.8, below).

### 3.3.2 Instrument Calibration and Standardization

*Chlorine.* Chlorine residual tests typically are conducted using a colorimetric test kit or via amperometric titration. The colorimetric test kit is the most commonly used method due to its portability. The amperometric titrator is more accurate and can serve many different purposes but is primarily for laboratory use due to its lack of portability. Inaccuracy of chlorine residual test kits can be caused by deterioration of the permanent color standards due to heat, sunlight or age. Color comparison standards must be replaced in accordance with manufacturer's recommendations. Readings should be compared with readings from an amperometric titrator or test kit of known accuracy at least on an annual basis. Reagents have a finite shelf life and deteriorate rapidly in conditions of sustained high temperatures or if exposed to sunlight. Reagents for chlorine test kits should be replaced with new reagents on a yearly basis. It shall be the duty of the section chief or program manager to check the test kits and reagents and ascertain accuracy. KDHE field and office staff are provided with chlorine residual test kits and the scope of this policy will be limited to this equipment.

### 3.3.3 Procedural Blanks, Duplicate Measurements and Spiked Samples

The possibility of sample contamination during sample preparation, storage and analysis is assessed through the use of procedural blanks, prepared with ASTM Type I-quality water and subjected to the same treatment as the rest of the samples collected as a result of the investigation or project. Under this protocol blanks are utilized in the following manner:

- a) Should the blank concentration exceed the sample concentration, a corrected concentration normally is not included in the data file; however, should the sample concentration be less than the minimum detection limit (MDL) of the analytical method, the concentration is recorded as such regardless of the blank concentration.
- b) Should the blank concentration be less than the MDL, the sample concentration is recorded without modification.



In the event a blank level exceeds the MDL, the level is not deducted from the reported sample concentration; rather, a sequence of corrective action procedures is initiated in accordance with section 3.6.

The possibility of sample contamination from sample containers is assessed through the analysis of container blanks. Five percent of the sample collection containers are selected at random, partially filled with ASTM Type I-quality water, sealed, and stored for a 48-hour interval. The resulting container blank is analyzed to determine levels of impurities leached from the container walls. If detectable concentrations of impurities are observed, a sequence of corrective action procedures is initiated.

#### 3.3.4 Preventative Maintenance

A preventive maintenance program will be maintained to ensure that all field sampling and laboratory equipment now owned by the bureau obtained in the future is maintained in good condition and is in a state of readiness. The section chief or program manager (Unit Chief) shall check field laboratory or sampling equipment on a quarterly basis and submit a check sheet to the bureau director for inclusion in the annual report. Specific preventive maintenance procedures are in accordance with manufacturer's recommendations and are written in Appendix B, Section II. Calibration of electronic equipment shall be performed on a quarterly basis.

#### 3.3.5 Safety Procedures

Safety procedures for handling field sampling and laboratory equipment must be followed carefully. Safety hazards include handling strong acids, strong bases, and toxic reagents.

### 3.4 External Procedures for assessing Data Precision, Accuracy, Representativeness and Comparability

#### 3.4.1 Onsite Audits

Bureau of Water monitoring programs may, at the discretion of the division director, or the granting agency, be required to participate in periodic QA/QC audits conducted by an independent third party. Audit findings, and corrective actions implemented in response to such findings, shall be reported to the bureau director and deputy division director and addressed in detail within the annual program evaluation.

#### 3.4.2 Interlaboratory Sample Comparison Programs

Whenever possible, samples shall be split between the water system or other entity and KDHE and the samples sent to the respective laboratories. Comparison between laboratory results shall be reviewed by the program manager or unit chief and passed on to the section chief for inclusion in the annual QA report. Consistent finding of disparities greater than 10% shall be cause for implementation of corrective action procedures.



### 3.5 Corrective Action Procedures

#### 3.5.1 Equipment Malfunction

Field equipment under BOW control is subject to corrective action procedures. Any deficiency in performance discovered during routine use or during an internal or external performance audit is recorded in the appropriate logbook and reported to the section chief. The section chief is responsible for appraising the scope and seriousness of the problem. Within manufacturer's guidelines, the section chief may elect to service the instrument or return the instrument to the manufacturer for repair or replacement, using a back-up unit in the interim.

The section chief is responsible for identifying any effects the equipment malfunction may have had on the quality of data collected. Data influenced by instrument malfunction are deleted from (or flagged within) the computer data file, at the discretion of the section chief.

#### 3.5.2 Sample Contamination

The discovery of sample contamination as outlined in section 3.3.3 will lead to corrective action procedures should the contamination exceed the MDL. Possible sources of contamination could include impure sample preservative, the wrong preservative, improper handling, or improper storage. The Chief of the Public Water Supply Section will investigate and take the necessary steps for correction. The steps taken will be recorded for inclusion in the annual QA report.

#### 3.5.3 Staff Performance Problems

Should a member of the project or field staff have difficulty with a given work procedure (e.g. as determined during an internal performance audit) an effort is made by the section chief to identify the scope and seriousness of the problem, identify any data affected by the problem, and recommend an appropriate course of corrective action. All affected data are either deleted from the file or flagged within the file, at the discretion of the section chief.

Possible corrective actions include further in-house or external training for the employee, a reassignment of work duties, or modification of the work procedure.

### 3.6 Data Management

Completed sample analysis reports from KHEL are delivered electronically to Chief of the Public Water Supply Section, then routed to the appropriate project staff or program manager for data reduction and validation. The data are checked for conspicuous oversights or dubious results. Should problems be noted in the data reports, corrective action procedures are initiated in accordance with section 3.6.



Each analysis report is electronically filed at the laboratory; hard copies are filed in the appropriate BOW file. Copies of PWS monitoring reports are kept on file for a minimum of ten years.

### 3.7 Quality Assurance Reporting Procedures

The section chief is responsible for informing the bureau director or division director of project QA/QC status and of any QA/QC needs within the public water supply program. He/She is also responsible for maintaining adequate communication with KHEL with regard to program QA/QC concerns.

In addition to these routine communication requirements, the section chief prepares an annual program QA/QC status report which is routed through the bureau director to the deputy division director. This report contains the following types of information:

- a) status of QA project plan;
- b) description of data accuracy, precision, completeness, representativeness and comparability;
- c) discussion of significant QA/QC problems, corrective actions, progress, needs, plans and recommendations;
- d) results of internal and any external system or performance audits;
- e) summary of QA/QC-related training performed since the last QA/QC status report; and
- f) any other pertinent information specifically requested by the bureau director or the deputy division director.



## **APPENDIX A**

### **STANDARD OPERATING PROCEDURE PWSS-001**

### **SAMPLE COLLECTION, PRESERVATION AND HANDLING**



## APPENDIX A

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## **I. SAMPLE COLLECTION, PRESERVATION AND HANDLING**

### **A. General Sampling and Collection**

The objective of any public water supply sampling program is to assure that any sample collected is representative of the water being sampled and that the preservation and handling of the sample is such that the integrity of the sample is maintained. The importance of good sampling, preservation and handling techniques is underscored by the fact that samples determine the safety of water for human consumption. Improper techniques could result in unsafe water supplied to consumers or could result in safe water being declared unsafe, causing unnecessary inconvenience and expense.

The following general precautions are to be observed in the collection of water samples for the public water supply program:

1. Make a record of every sample collected and identify every bottle, preferably by attaching an appropriately inscribed tag or label. Be sure to record the date, time, the exact location, name of the sample collector, and any other information which may be needed to identify the sample.
2. Before collecting samples from distribution systems, flush lines sufficiently to insure that the sample is representative of the supply, taking into account the diameter and length of pipe and the velocity of flow. (Not applicable for lead and copper sampling.)
3. Collect samples from wells only after the well has been pumped sufficiently to insure that the sample represents the groundwater source. Record pumping rate and drawdown.

### **B. General Sampling Procedures**

Water supply operators should follow these general procedures for quality sampling. The KDHE laboratory or commercial laboratories may recommend procedures for sampling and addition of preservatives for specific contaminants.

1. Collect the samples immediately prior to shipment to the laboratory.
2. Read the laboratory's sampling instructions carefully. The sampling containers may contain a preservative, therefore do not rinse prior to sample collection. Do not add preservatives unless directed to do so by the laboratory. If cold packs are to be used, freeze them prior to sample collection.



3. Choose the sampling point. The sampling point should be representative of the water after treatment. Generally, samples should be taken at the tap on the pipeline before the treated water is sent to the distribution system. Sampling taps are usually available in the plant laboratory for the water entering the distribution system. Note: bottles must not be filled near gasoline cans, gasoline powered engines, paint cans, lighter fluid, paint strippers, pesticide bottles or exhaust fumes from running engines. Fumes and vapors may contaminate the samples.
4. Remove any attachment (such as a hose, strainer or aerator) from the tap.
5. Flush the tap for more than 3 to 5 minutes or until the water temperature becomes stable. This helps ensure a representative water sample.
6. While the water is running and before collecting the sample, fill out the label or lab sheet with the following information:
  - a. Entry point site ID number
  - b. Exact location of sampling
  - c. Date and time the sample was collected
  - d. Type of analyses to be conducted
7. Position the container under the tap and collect the required volume of water. Introduce the water very carefully to reduce agitation and to avoid introducing air bubbles. Fill the bottle so that little or no air space will remain in the bottle after the cap is tightened.
8. Follow any instructions by the laboratory regarding the addition of any biocide, acid, or other preservative to the container. In general, bottles obtained from the KDHE laboratory have the required preservative.
9. Screw the cap on the container. Do not touch the inside of the cap and do not overtighten. Use extra caps or septa provided by the laboratory if the originals become contaminated or broken.
10. Follow bureau and program QA/QC procedures regarding replicate samples, field blanks, or other samples needed for quality control.



11. Complete information on the form as in #6, above. Fill out the chain of custody section of the sample collection form at the time the sample is taken. Use waterproof ink. Print or write legibly and note any condition which could indicate sample contamination.
12. Pack and transport the samples. Samples must be kept at or below the required temperature, but not allowed to freeze. If they need to be refrigerated, cool them with ice, or pre-frozen chemical cold packs (blue ice), to keep them below 4 degrees Celsius. To protect the samples from breakage, packing materials such as bottle holders, cardboard, or polystyrene foam should be used, rather than ice, which can melt and leave excessive space. If the laboratory is within driving distance a picnic cooler is ideal for transport. Samples shipped by commercial carrier should be protected against breakage and spillage by a suitable shipping case.
13. Ship or deliver the samples to the laboratory the same day or by overnight courier. The temperature of the samples must be kept at or below four degrees celsius during shipping and before analysis.

### C. Bacteriological Sampling

Following are directions for collection of bacteriological samples:

1. Use only the sterile bottle furnished by the KHEL Microbiology section. Keep bottles sealed until used.
2. Collect samples from rigid faucets. Do not collect from yard hydrants, fire hydrants, frost-free hydrants, leaking faucets, or hot water faucets. Avoid outside sillcocks, swing faucets, or single handle faucets whenever possible. Do not collect all samples from the same site unless there is only one service connection in the system.
3. Water softeners, charcoal filters, and aerators are sometimes sources of bacteriological contamination and should be avoided. Remove aerators or filters before sampling.
4. Wash hands before beginning sampling procedures. Run the water at a steady rate for 3 to 5 minutes before sampling. Do not adjust the flow of water.
5. Remove the bottle lid just before filling. Holding the lid in your free hand, fill the bottle to the shoulder. Avoid having water splash out of the bottle or overflow. Replace the lid and tighten securely. Dry the outside of the bottle before packing.



6. Complete the information on the sampling data card:

- a. Collection date
- b. Print collector's name
- c. Time of day
- d. Collection location
- e. Chlorine residual
- f. Any comments which would be helpful to the laboratory.

Failure to provide items a through d with the sample will invalidate the sample and, in the case of public water supply collection, could cause a monitoring violation.

- 7. Enclose the sampling card and bottle in the shipping container, fasten the lid securely, and place mailing label on the container. Ship sample by first class mail or by courier.
- 8. Collection of the sample in the afternoon may reduce the transit time. The sample must reach the lab in 48 hours or it will be too old to analyze. Ship the sample on a Monday, Tuesday or Wednesday unless there is a holiday in the week. Avoid having a sample arrive at the lab on holidays or weekends.
- 9. In the case of public water supply systems, a sample should be collected in each bottle sent. Samples not collected during a sample period will result in a monitoring violation. Failure to return check samples or replacement samples could also result in monitoring violations. Empty returns must have a documented reason or could result in monitoring violations.

D. Sampling for Inorganic Compounds

The general sampling procedures for collecting samples for inorganic analysis or for monitoring of inorganics are as follows:

- 1. Select the sampling point
- 2. Remove any attachment from the tap
- 3. Flush the water for 3 to 5 minutes or until the water temperature has stabilized.
- 4. While the water is flushing, fill out the label or sample sheet with the required information.
- 5. Fill the container with the required volume of water.



6. The laboratory will, except under emergency conditions, have added the correct preservative to the sample bottles. This preservative is a concentrated solution of nitric acid. Do not add further acid to the KDHE metals container. Note: samples for cyanide cannot be collected in the same container. A preservative which raises the pH to greater than 12, sodium hydroxide, is needed.
7. Under emergency conditions where a sample must be collected for metals analysis and a KDHE container is not available, add 3 ml of nitric acid for each liter of sample. **Caution: Nitric acid is a very strong acid. Avoid contact with skin or eyes or sever injury could result. Safety precautions include goggles and gloves. Use water to wash off skin or clothing as soon as possible after contact.**
8. Screw the cap on the bottle.
9. Repeat steps 4 to 8 for replicate samples.
10. Complete the sample collection forms.
11. Pack the samples in an ice chest.
12. Ship or deliver the samples to the laboratory the same day or by overnight courier.

E. Sampling for Volatile Organic Chemicals (VOCs)

Samples for VOC analysis may be collected to determine compliance with MCL's or for investigatory purposes. Following are the procedures for collecting VOC samples:

1. Locate the sampling point.
2. Remove any attachment from the tap.
3. Flush for several minutes at a rate of about a quart a minute. Note: vials (40 ml) contain ascorbic acid powder to quench excess chlorine. Prior to filling, tap the bottle to make sure powder is at the bottom of the vial and not sticking to the cap liner.
4. Fill each of the two vials three quarters of the way with water. With a disposable glass pipette, add three drops of 1:1 HCl (50% hydrochloric acid solution) to the water in the vial. **Caution: 50% Hydrochloric is a strong acid. Wear eye protection. Wash any spillage from skin with plenty of tap water.**
5. Slowly and carefully finish filling each vial with water to the lip, so as not to overflow the vial.
6. Set the vial on a flat surface. Float the teflon-lined septum (cap liner) on top of the water in the vial, with the teflon side (white thin-layered side) in contact with the water. Screw cap on tightly. Turn vial upside down, shake vigorously for ten seconds and check for air bubbles. If air bubbles are present discard the sample and repeat sample collection with a new vial that contains the quenching agent.



7. Label the vial with appropriate identification: PWS Name, PWS Account Number, KDHE Point of Entry Site ID Number (tag), Date, Time, Collector and place in shipper slots.
8. Complete the sample collection forms including the chain of custody section.
9. Pack the samples into an ice chest to keep the temperature of the samples at or below 4 degrees C.
10. Ship or deliver samples to the laboratory the same day or by overnight courier.
11. If using mailer kits, wrap vial with paper towel provided; place in metal shipping tube and screw on lid. Place the metal container and sample collection form in the shipping carton and close. If shipping by mail several cartons can be placed together and shipped in a box, or each carton can be addressed and shipped separately. Be sure to attach proper postage.
12. Samples must be analyzed within 14 days of collection, therefore it is important they be submitted as soon as possible after collection.

F. Sampling for Synthetic Organic Chemicals (SOC) Analysis.

The following procedures are for the purpose of collecting samples for analysis of Synthetic Organic Chemicals (SOCs):

1. Locate the sampling point.
2. Remove any attachment from the tap.
3. Flush the tap for about 3 to 5 minutes (or until the water temperature stabilizes) at a rate of about a quart a minute.
4. Take the bottle labelled "C", a 120 ml clear Boston Round bottle for carbamate analysis. Fill it three quarters of the way with water. Remove the small 5cc vial from the shipping container. Unscrew the cap and add the contents of this vial to the bottle by tilting the vial at a 45 degree angle directly over the mouth of the bottle and tapping gently on the side of the vial. Screw the cap back on the vial and put it back in the shipper. **Caution: the 5 cc vial labeled "C" contains chloroacetic acid buffer at a pH of 3. Wear eye protection. Wash any spillage from skin with plenty of tap water.**
5. Finish filling the bottle, but only to the base of the neck of the bottle. Replace the cap and shake the bottle vigorously for ten seconds.
6. Label the bottle with the appropriate identification: PWS Name, PWS Account Number, KDHE POE Site ID (tag) Number, Date, Time, Collector, etc. and place in the shipper slot.



7. Bottles labeled "D", "E", "F", and "G" are one liter amber Boston Round bottles for the remaining SOCs.
8. Remove cap and fill bottle "D" three quarters of the way with water. Remove the small 5cc vial labeled "D" from the shipper. Unscrew the cap and add the contents of this vial to the bottle by tilting the vial at a 45 degree angle directly over the mouth of the bottle and tapping gently on the side of the vial. Screw the cap back on the vial and put it back in the slot in the shipper. **Caution: the 5cc vial labeled "D" contains a 50% hydrochloric acid solution (1:1 HCl). Wear eye protection. Wash any spillage from skin with plenty of tap water.**
9. Finish filling the bottle, but only to the base of the neck of the bottle. Replace the cap and shake the bottle vigorously for ten seconds.
10. Remove the caps and fill bottles labeled "E", "F" and "G" to the base of the neck with water. Replace the caps and shake vigorously for ten seconds.
11. Label the bottles with the appropriate identification: PWS Name, PWS Account Number, KDHE POE Site ID (tag) Number, Date, Time, Collector, etc. and place in the shipper slot.
12. Add three frozen freeze packs to shipper and replace the styrofoam lid.
13. Fill in all applicable parts of the PWS Sample Submission Form. Place form and instruction sheet on the lid of the shipper and close flaps of box.
14. Deliver samples to laboratory within 24 hours of collection. Keep custody of samples at all times during storage and transport. Complete "Chain of Custody" section on the sample submission form when relinquishing samples.

#### G. Asbestos Sampling Procedures

Glass or plastic bottles are required for taking samples. The volume depends on the requirements of the testing lab but must be at least one liter. Typical containers include the one liter cubitainer and one-liter quart bottles. Following are the procedures to follow in collecting asbestos samples:

1. Locate the sampling point or points.
2. Remove any attachment from the tap.
3. Flush the tap for 3 to 5 minutes or until the water temperature stabilizes.
4. While the water is running fill out the sample collection sheet and bottle label.
5. Fill the bottle or cubitainer with the required volume of water and screw the cap on the bottle.
6. Repeat these procedures for all replicate samples.



7. Pack the samples in an ice chest.
8. Ship or deliver to the laboratory the same day or by overnight courier.

#### H. Radon Sampling Procedures

For radon sampling a sampling kit with the necessary equipment is essential. The kit consists of the following:

1. Sampling funnel with tube and faucet adaptor
2. One plastic syringe with hypodermic needle and four glass scintillation vials with polyseal caps. Each contains 10 ml mineral oil based liquid scintillator. These are inside the box marked "Sample".
3. Return label and postage; sealing tape.

The procedures for sample collection are as follows:

1. Attach the sampling funnel and tube to the faucet with the faucet adaptor. (Figure A-1)
2. Slowly turn on the water and allow a steady stream to flow out of the funnel for approximately two minutes.
3. Reduce the flow of water. The flow should be adjusted to a level that does not cause turbulence in the pool of water contained in the funnel. Allow excess water to spill over one edge of the funnel.
4. Examine the hose connection and tubing for air bubbles or pockets. If these are visible, raise or lower the funnel until they are removed.
5. Place the tip of the hypodermic needle approximately 3cm under the surface of the water in the funnel and withdraw a few milliliters of water and eject this water. Using this procedure, rinse the syringe and hypodermic needle two or three times.
6. Again, place the tip of the needles approximately 3 cm below the surface of the water and withdraw over 10 ml. Record the time of collection. Note: the water should be pulled into the syringe slowly to avoid turbulence and collection of air bubbles. If large air bubbles are noticed in the syringe, the sample should be ejected and redrawn.
7. Invert the syringe and slowly eject any small air bubbles and extra water. Retain precisely 10 ml of water in the syringe.
8. Remove the cap from a glass scintillation vial and carefully place the tip of the needle into the bottom of the liquid scintillation solution. Slowly eject the water from the syringe into



the vial. Note: The water is injected under the liquid scintillation solution to prevent loss of radon from the sample. If turbulence is caused, it could cause loss of radon.

9. Carefully withdraw the hypodermic needle from the vial and replace the cap. The cap should be tightly secured to prevent leakage.
10. Repeat the previous steps to obtain two more samples. A total of three samples should be taken from each source. This completes the sample collection.
11. Complete the sample data form (Figure A-2)
12. Use the original shipping box to return sampling kits, sample data form and samples to the Radiation Laboratory.

#### I. Nitrate/Nitrite Sampling Procedures

Nitrate and nitrite samples are collected to check compliance with the maximum contaminant levels specified in the Safe Drinking Water Act and Kansas regulations. Following are the procedures for sample collection:

1. Locate the sampling point(s).
2. Remove any attachments from the tap. Be sure there are no point of use devices such as reverse osmosis units which could alter the result.
3. Flush the tap for 3 to 5 minutes or until the water temperature stabilizes. Meanwhile fill out the sample collection form and container label.
4. Fill the KDHE nutrient bottle with water sample. Be sure not to overfill or splash out the preservative. **Caution: the preservative is a strong sulfuric acid solution. Wear eye protection. Flush skin with plenty of tap water.**
5. Screw the cap on the bottle.
6. Repeat the procedure for all replicate samples.
7. Complete the sample submission forms including the chain of custody section.
8. Pack the samples in an ice chest and ship to the laboratory the same day or send by overnight courier.



**Table A-1**  
**Sample Preservation and Holding Times**  
**TABLE 1060:I SUMMARY OF SPECIAL SAMPLING OR HANDLING REQUIREMENTS**

Determination	Container	Minimum Sample Size	Preservation	Maximum Storage Recommended/Regulatory†
<i>mL</i>				
Acidity	P,G(B)	100	Refrigerate	24 h/4 d
Alkalinity	P,G	200	Refrigerate	24 h/14 d
BOD	P,G	1000	Refrigerate	6 h/48 h
Boron	P	100	None required	28 d/6 months
Bromide	P,G	-	None required	28 d/28 d
Carbon, organic, total	G	100	Analyze immediately; or refrigerate and add IICI pfl<2	7 d/28 d
Carbon dioxide	P,G	100	Analyze immediately	stat/N.S.
COD	P,G	100	Analyze as soon as possible, or add H <sub>2</sub> SO <sub>4</sub> to pli<2; refrigerate	7 d/28 d
Chlorine, residual	P,G	500	Analyze immediately	0.5 h/stat
Chlorine dioxide	P,G	500	Analyze immediately	0.5 h/N.S.
Chlorophyll	P,G	500	30 d in dark 30 d/N.S.	
Color	P,G	500	Refrigerate 48 h/48 h	
Conductivity	P,G	500	Refrigerate 28 d/28 d	
Cyanide: Total	P,G	500	Add NaOH to pH> 12, refrigerate in dark	24h/14d;24h if sulfide present
Amenable to chlorination	P,G	500	Add 100 mg Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> /L	stat/14d;24h if sulfide present
Fluoride	P	300	None required	28 d/28 d
Hardness	P,G	100	Add HNO <sub>3</sub> to pH<2	6 months/6 months
Iodine	P,C	500	Analyze immediately	0.5 h/N.S.
Metals, general	P(A),G(A)	-	For dissolved metals filter immediately, add HNO <sub>3</sub> to pH<2	6 months/6 months
Chromium VI	P(A),G(A)	300	Refrigerate	24 h/24 h
Copper by colorimetry*	P(A), G(A)	500	Add NHO <sub>3</sub> to pH<2,4°C, refrigerate	28 d/28 d
Mercury	P, G	500	Analyze as soon as possible or add H <sub>2</sub> SO <sub>4</sub> to pH<2, refrigerate	7 (1/29 d
Nitrogen: Ammonia	P, G	100	Analyze as soon as possible or for chlorinated	48 h,@48 h(28d
Nitrate	P, G	200	Add H <sub>2</sub> SO <sub>4</sub> to pli<2, refrigerate	samples) none / 28 d
Nitrate + nitrite	P, G	100	Analyze as soon as possible or refrigerate	none /48 h
Nitrite	P, G	500	Refrigerate, add H <sub>2</sub> SO <sub>4</sub> to pH<2	7 d/28 d
Organic, Kjeldahl	G	500	Analyze as soon as possible, refrigerate	6 h/N. S.
Odor	G, wide-mouth calibrated	1000	Add H <sub>2</sub> SO <sub>4</sub> to pH<2, refrigerate	28 d/28 d
Oil and grease				
Organic compounds: Pesticides	G(S), TFE-lined cap -		Refrigerate; add 1000 mg ascorbic acid/L if residual chlorine present	7 d/7 d until extraction; 40 d after extraction
Phenols	P, G	500	Refrigerate, add H <sub>2</sub> SO <sub>4</sub> to pH<2	*/28 d
Purgeables by purge and trap	G, TFE-lined cap	50	Refrigerate; add IICI to pH < 2; add 1000 mg ascorbic acid/L if residual chlorine present	7 d/14 d
Oxygen, dissolved: Electrode	G, BOD bottle	300	Analyze immediately	0.5 h/stat
Winkler			Titration may be delayed after acidification	8 h/8 h
Ozone	G	1000	Analyze immediately	0.5 h/N.S.
pH	P, G	-	Analyze immediately	2 h/stat
Phosphate	G (A)	100	For dissolved phosphate filter immediately; refrigerate	48 h/N.S.
Salinity	G, wax seal	240	Analyze immediately or use wax seal	6 months/N.S.
Silica	p	-	Refrigerate, do not freeze	28 d/28 d
Sludge digester gas	G, gas bottle	-	-	N.S.
Solids	P, G	-	Refrigerate	7 d,12-7 d, see cited reference
Sulfate	P, G	-	Refrigerate	28 d/28 d
Sulfide	P, G	100	Refrigerate; add 4 drops 2N zinc acetate/100 mL; add NaOH to pH>9	28 d/7 d
Taste	G	500	Analyze as soon as possible; refrigerate	24 h/N@ S.Temperature
Turbidity	P, G	-	Analyze immediately	stat/stat
	P, G	-	Analyze same day; store in dark up to 24 h, refrigerate	24 h/48 h

\*See text for additional details. For determinations not listed, use glass or plastic containers; preferably refrigerate during storage and analyze as soon as possible. Refrigerate = storage at 4°C in the dark. P = plastic (polyethylene or equivalent); G = glass; G(A) or P(A) = rinsed with 1 + 1 HNO<sub>3</sub>; G(B) = glass, borosilicate; G(S) = glass, rinsed with organic solvents; N.S. = not stated in cited reference-, stat = no storage allowed, analyze immediately. † Environmental Protection Agency. Rules and Regulations. Federal Register 49; No. 209, October 26, 1994. See this citation for possible differences regarding container and preservation requirements.





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## Kansas Department of Health and Environment

Division of Health and Environmental Laboratories  
Radiochemistry Laboratory

### Radon in Water Sample Collection Instructions

The sampling kit should contain a faucet adapter connected to a funnel, a syringe, a hypodermic needle and four vials containing 10 ml of a mineral oil based liquid. Although only 3 vials are needed for radon analysis; fill all four vials provided, in case damage occurs during shipment.

#### Sample Collection Procedures

Attach the faucet/funnel assembly to the faucet.

Slowly turn on the water and allow a steady stream to flow out of the funnel for approximately 2 minutes. Allow excess water to flow over the edge of the funnel.

Reduce the flow of the water. It should be adjusted to a level that does not cause turbulence in the pool of water contained in the funnel.

Examine the hose connection and tubing for air bubbles or pockets. If these are visible, raise or lower the funnel until they are removed.

Screw the hypodermic needle into the syringe and remove the cover. Then place the tip of the needle approximately 3 cm (1 inch) under the surface of the water in the funnel and withdraw a few cc's of water and discard. Rinse the needle 3 times in this fashion.

Again, place the tip of the needle approximately 3 cm below the surface and **slowly** withdraw over 10 cc's of water - avoiding extreme turbulence and air bubbles. If large air bubbles are noticed in the syringe then discard the water and redraw a sample. Note the time of collection.

Remove the syringe and needle and point it upwards, **slowly** eject any small air bubbles and extra water. Retain precisely 10 cc's of water in the syringe.

Remove the cap from a vial and carefully stick the tip of the needle to the bottom of the vial. **Slowly** eject the water from the syringe into the vial underneath the mineral oil based liquid. Be careful not to create too much turbulence.

Remove the needle and syringe, replace the cap on the vial, and tighten securely.

Repeat the previous steps until all vials are filled.

Complete the radon sample data form ( attached ), and return the entire kit back to the laboratory.

If you have any questions concerning radon sample collection, please call the Radiochemistry Laboratory at 785-296-1630.



**Kansas Department of Health and Environment**  
Division of Health and Environmental Laboratories  
Radiochemistry Laboratory

Radon in water sample data form

Collection Date: \_\_\_\_\_ Collection Time: \_\_\_\_\_ **AM or PM**  
(Use the average time of the samples collected)

Collection Location: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Public Water Supply Account # (if any): \_\_\_\_\_

Send Additional Reports to: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Sample Collected by: \_\_\_\_\_ Phone: \_\_\_\_\_

Radon Kit ID #: \_\_\_\_\_

Radon samples must arrive at the laboratory ( on a business day ) less than 4 days after collection

**For Laboratory Use Only**

Laboratory Number: \_\_\_\_\_

Received By: \_\_\_\_\_

Date and Time Received: \_\_\_\_\_

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



## APPENDIX B

### **STANDARD OPERATING PROCEDURE PWS-002**

### **CHLORINE RESIDUAL TESTS**



## I Chlorine Residual Tests

### A. Hach Chlorine Residual Test Kit CN 66

1. Rinse viewing tubes thoroughly before conducting the test. The powder does not have to dissolve completely to obtain correct readings. If high concentrations of monochloramine are present they may interfere in the free chlorine determination after one minute developing time. Therefore it is important that the results be read within one minute as noted in the instructions for the free chlorine residual test.

#### *Free Chlorine Residuals.*

1. Fill a color viewing tube to the 5 ml mark with clear water and place it in the left top opening of the color comparator.
2. Fill the other viewing tube to the 5 ml mark with the water to be tested. **WARNING: The chemicals in this kit may be hazardous to the health and safety of the user if inappropriately handled. Please read all warnings before performing the test and use appropriate safety equipment.**
3. Use the clippers to open one DPD Free Chlorine Reagent Powder Pillow or tear open the corner of a foil packet, if applicable. Add the contents of the pillow or packet to the sample to be tested. Swirl the tube to mix. Place the sample tube in the top right opening of the comparator.
4. Hold the comparator up to a light source, such as a window, the sky or a lamp, and view through the openings in front. Rotate the disc until a color match is obtained. Read the mg/l free chlorine within one minute through the scale window.

#### *Total Chlorine Residual Test.*

1. Fill a color viewing tube to the 5 ml mark with clear water and place it in the left top opening of the comparator.
2. Fill the other viewing tube to the 5 ml mark with the water sample to be tested.
3. Use clippers to open one DPD Total Chlorine Reagent powder pillow, or foil packet, if applicable. Add the contents to the test sample. Swirl the sample tube to mix. **Let stand for three minutes, but not more than six minutes**, to allow color development. Place the sample tube in the right top opening in the comparator.
4. Hold the comparator up to a light source and view through the openings in front. Rotate the disc until a color match is obtained. Read the mg/l total chlorine through the scale window.



## II. Checking the Chlorine Residual Test Kit

At least yearly, check the kit against a new test kit or an amperometric titrator. Using fresh reagents, dose a water sample and take the reading of the test kit being checked. Then, quickly check the sample in the new test kit. Alternatively, check a 200 ml sample in an amperometric titrator and record the reading. Compare the reading of the test kit to this reading. The test kit reading should be within 10 % of the reading obtained by the new test kit or amperometric titrator. If not, replace the color wheel.



## APPENDIX C

### **STANDARD OPERATING PROCEDURE PWSS-003**

### **MANAGEMENT AND REPORTING OF DATA**



## I. DATA CUSTODY

The purpose of this standard operating procedure (SOP) is to establish uniform policies and procedures for maintaining an accurate written record of a sample from the time it is collected through its introduction as evidence into litigation proceedings and to insure that a sample has not been tampered with or altered throughout the process.

### A. The sample by definition is in custody if:

1. It is in actual physical possession of the sample collector.
2. It is in view of the sample collector after being in the collector's physical possession.
3. It is locked up after being in the sample collector's physical possession.
4. It is placed in a designated secure area.

### B. FIELD PROCEDURES

1. Chain-of-Custody procedures will be followed for all tests deemed to be of importance for compliance with statutes and regulations and for those which could become evidence in litigation. Samples for plant process control, field screening analyses, or other samples collected for a technical or information purposes will not need to follow chain-of-custody procedures. In general, those samples submitted to the KDHE laboratory will be subject to chain-of-custody procedures.
2. In order to insure adequate control and documentation of collected samples, the number of personnel handling the samples should be minimized.
3. A unique number shall be assigned to each sample for identification purposes. If a sample consists of several bottles for analysis of different parameters from the same sample, the same sample number is used for each portion of the original sample.
4. If the samples are to be shipped to other laboratories for analysis a sample label is attached to each sample container at the time of collection.
5. Record all field measurements and other pertinent data on the field sheet.
6. Custody of the sample is initiated at the time of sample collection by insuring that the sample is in the sample collector's physical possession or view at all times, or is stored in a locked place where there could be no reasonable possibility of tampering. The sample collector is responsible for the collected samples until they are received by the laboratory or have been appropriately shipped to the lab. The chain of custody record is initiated at the time of sample collection and a copy accompanies the samples. The chain of custody record is at the bottom of the KDHE laboratory sheet. Signatures and dates on the sample custody sheet shall be signed in indelible ink. The sample shall make sure the name, date, time, exact location, sample identifiers and parameters for analysis are listed before signing off. The person assuming custody shall sign and date the custody section of the sheet in the sample collector's presence. An exception is samples delivered after



hours; these must be placed in the designated sample storage area of the KDHE laboratory by the individual having custody.

## II. DATA MANAGEMENT

Data received from the laboratory shall be forwarded to the Chief of the Public Water Supply Section, Bureau of Water, or a designated project manager. The data will be examined and any unusually high values or values considered to be unreasonable will be noted and brought to the attention of the laboratory and the appropriate section or unit chief. High values for a given contaminant or parameter may indicate a real problem, but occasionally occur as a result of a decimal error, a missed dilution at a permittee laboratory, sample collection at the wrong location or other error. Such errors should be corroborated and noted and initialed on the data reporting sheet prior to passing the information along or filing.

Significant figures must be checked to ascertain that no unusual degree of accuracy is implied by the result. For instance, BOD values expressed to thousandth of a milligram per liter.

The laboratory results shall then be forwarded to the appropriate section or project manager. The copy distribution list shall be reviewed to make sure the information is distributed to all who need it. A copy is routed to the appropriate file and/or electronic data base.



## APPENDIX D

### **STANDARD OPERATING PROCEDURE PWSS-004**

### **EVALUATION OF DATA QUALITY**



## QUALITY CONTROL AND STATISTICAL EVALUATION OF DATA

Accuracy is a measure of how closely the analytical result or the average of a set of analytical tests approaches the true value of a parameter. Two types of error affect accuracy: systematic error and random error. An example of systematic error would be inaccuracy in a piece of laboratory equipment, for example a laboratory balance that consistently under-weighs. Random error is error from a variety of sources which cannot be totally controlled. Errors in the use of pipettes, graduated cylinders, or other laboratory equipment are examples. Random error is controlled by averaging a series of replicate analyses of a sample.

Precision measures how closely a series of replicate measurements approach the average. It is a measure of how well results can be reproduced. A laboratory may have a high degree of precision on a given test but be inaccurate. It is necessary to control both precision and accuracy to achieve a consistency of data quality.

A number of methods are available for evaluating both accuracy and precision. However these measures do not account for errors in sampling and handling that occur prior to laboratory analysis.

### A. Commercial Laboratories

Commercial laboratories providing drinking water quality data to the bureau for compliance purposes shall be certified by the Kansas Department of Health and Environment and shall follow the Laboratory Certification Section guidelines for data evaluation and quality.

### B. Contract laboratories analyzing samples for a bureau project must conform to the following general guidelines for data quality and evaluation:

1. At least 10% of a given number of samples should be for quality control purposes. At least one blank, one spike sample and one set of duplicates shall be analyzed with each sample set.
2. For accuracy determinations spiked samples shall be used. The use of spikes is preferable to the use of analysis of known standards as the spikes more nearly approach the true range of values encountered in analyzing the samples. The procedure involves the addition of a known quantity of standard to a known volume of unknown sample. Replicate analyses of both the known and the unknown sample are run and the results are compared to generate a percent recovery. Ideally, the result should be 100% but results between 90% and 110% are acceptable. The procedure for calculating percent recovery is as follows:



- a. Determine the unknown sample concentration by averaging the results of replicate analyses.
- b. Calculate the theoretical concentration of the spiked sample. (See Wastewater Sampling for Process and Quality Control, Water Environment Federation, 1979, p64.
- c. Determine the spiked sample concentration by averaging the results of the duplicate analyses.
- d. Divide the spiked sample concentration by the theoretical concentration. Multiply the result by 100. The result is the percent recovery.

For measurement of precision it is necessary to measure a series of replicate samples. The degree of precision required shall be determined at the outset of the project and incorporated into the project QA/QC Plan. The determination of precision shall be through the use of average deviation, variance and standard deviation.



## **APPENDIX E**

## **BIBLIOGRAPHY**



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